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U.S. Army Toxic and Hazardous Materials Agency

**Enhanced Preliminary
Assessment Report:**

**Manassas Army Housing Units
Independent Hill, Virginia**

October 1989

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prepared for

Commander
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland 21010-5401

prepared by

Environmental Research Division
Argonne National Laboratory
Argonne, Illinois 60439

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Commander, U.S. Army Toxic and Hazardous Materials Agency,
Aberdeen Proving Ground, Maryland 21010-5401



Environmental Research Division,
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19. ABSTRACT (Continue on reverse if necessary and identify by block number) Argonne National Laboratory has conducted and enhanced preliminary assessment of the Army housing property located in Independent Hill, VA. The objectives of this assessment include identifying and characterizing all environmentally significant operations, identifying areas of environmental contamination that may require immediate remedial actions, identifying other actions which may be necessary to resolve all identified environmental problems, and identifying other environmental concerns that may present impediments to the expeditious sale of this property. <i>Keywords</i> <i>Contamination, Hazardous materials, Health, Housing (Dwellings), Guided missiles, Toxicity. (S)</i>															
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SUMMARY

The Manassas housing area located just outside Independent Hill, Va., does not present an imminent or substantial threat to human health or the environment. There is no evidence to suggest that hazardous or toxic constituents have ever been released from this property. There are no reported environmental impacts from this property, and during a recent site investigation none was identified.

This property was originally developed as part of a Nike missile battery at Independent Hill, Va., approximately 11 miles southeast of Manassas, Va. The area has always been used solely for housing military personnel. No wastes associated with the operation and maintenance of the missile-launch and fire-control systems were ever delivered to or managed at this housing area. The area now uses the electrical service of a public utility. During the Nike battery's active life, however, power to the area was supplied by the battery's adjacent fire-control site. No records were available to indicate whether utility connections were properly removed or sealed.

While the Manassas housing area poses no imminent or substantial threat to human health or the environment, the following actions are recommended prior to release of this property:

- Soils surrounding the locations of the area's former underground fuel-storage tanks should be sampled for possible contamination and any problems remediated in accordance with accepted practice.
- The underground electrical and water utilities that once connected this housing area to the adjacent Nike fire-control site should be investigated to confirm that the utilities were properly abandoned.

The recommendations assume that this property will most likely continue to be used for residential housing.

1 INTRODUCTION

In October 1988, Congress passed the Defense Authorization Amendments and Base Closure and Realignment Act, Public Law 100-526. This legislation provided the framework for making decisions about military base closures and realignments. The overall objective of the legislation is to close and realign bases so as to maximize savings without impairing the Army's overall military mission. In December 1988, the Defense Secretary's ad hoc Commission on Base Realignment and Closure issued its final report nominating candidate installations. The Commission's recommendations, subsequently approved by Congress, affect 111 Army installations, of which 81 are to be closed. Among the affected installations are 53 military housing areas, including the Manassas housing area addressed in this preliminary assessment.¹

Legislative directives require that all base closures and realignments be performed in accordance with applicable provisions of the National Environmental Policy Act (NEPA). As a result, NEPA documentation is being prepared for all properties scheduled to be closed or realigned. The newly formed Base Closure Division of the U.S. Army Toxic and Hazardous Materials Agency is responsible for supervising the preliminary assessment effort for all affected properties. These USATHAMA assessments will subsequently be incorporated into the NEPA documentation being prepared for the properties.

This document is a report of the enhanced preliminary assessment (PA) conducted by Argonne National Laboratory (ANL) at the Army stand-alone housing area in Independent Hill, Va.

1.1 AUTHORITY FOR THE PA

The USATHAMA has engaged ANL to support the Base Closure Program and assess the environmental quality of the installations proposed for closure or realignment. Preliminary assessments are being conducted under the authority of the Defense Department's Installation Restoration Program (IRP); the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 91-510, also known as Superfund; the Superfund Amendments and Reauthorization Act of 1986, Public Law 99-499; and the Defense Authorization Amendments and Base Closure and Realignment Act of 1988, Public Law 100-526.

In conducting preliminary assessments, ANL has followed the methodologies and procedures outlined in Phase I of the IRP. Consequently, this PA addresses all documented or suspected incidents of actual or potential release of hazardous or toxic constituents to the environment.

In addition, this PA is "enhanced" to cover topics not normally addressed in a Phase I preliminary assessment. Specifically, this assessment considers and evaluates the following topical areas and issues:

- Status with respect to regulatory compliance,
- Asbestos,
- Polychlorinated biphenyls (PCBs),
- Radon hazards (to be assessed and reported on independently),
- Underground storage tanks,
- Current or potential restraints on facility utilization,
- Environmental issues requiring resolution,
- Health-risk perspectives associated with continued residential land use, and
- Other environmental concerns that might present impediments to the expeditious "excessing," or transfer and/or release, of federally owned property.

1.2 OBJECTIVES

This enhanced PA is based on existing information from Army housing records of initial property acquisition, initial construction, and major renovations and remodeling performed by local contractors or by the Army Corps of Engineers. The PA effort does not include the generation of new data. The objectives of the PA include:

- Identifying and characterizing all environmentally significant operations (ESOs),
- Identifying property areas or ESOs that may require a site investigation,
- Identifying ESOs or areas of environmental contamination that may require immediate remedial action,
- Identifying other actions that may be necessary to address and resolve all identified environmental problems, and
- Identifying other environmental concerns that may present impediments to the expeditious transfer of this property.

1.3 PROCEDURES

The PA began with a review of Army housing records located at Vint Hill Farms Station, Va., on May 24, 1989. A site visit was conducted on the same day at the Manassas Family Housing site located at Independent Hill, Va., to obtain additional information through direct observation and interviews with personnel familiar with the property and its operations and history. Photographs were taken of the housing units and surrounding properties as a means of documenting the condition of the housing units and immediate land uses. Site photographs are appended.

All available information was evaluated with respect to actual or potential releases to air, soil, and surface and ground waters.

Access to individual housing units was obtained through the senior occupant at the facility.

2 PROPERTY CHARACTERIZATION

2.1 GENERAL PROPERTY INFORMATION

The Manassas housing area consists of nine units on a 4.42-acre site located in the northeastern tip of Virginia, 0.2 mile southeast of Independent Hill, which is approximately 11 miles southeast of Manassas and about 25 miles southwest of Washington, D.C. The property is in Prince William County, Va. Terrain in the general area of the housing property is a grassy rolling plain, with a scattering of trees.

The nine houses were constructed on the property in 1956. The nine as originally constructed are wood frame with inorganic shake siding on a concrete slab foundation covered with asphalt tile. Each unit was equipped with forced-air oil furnaces at the time of construction, and with air conditioning units added at a later date. The units currently house noncommissioned military personnel stationed at Vint Hill Farms Station and their dependents.

The property occupies the southwest corner of the intersection of Rts. 646 and 619 in Independent Hill. Six of the housing units face north on Rt. 646, and three units face east on Rt. 619. A chain link fence separates the housing area from Prince William County School District property, immediately south of the housing area. (See Sec. 2.3.2 for additional discussion of the previous uses of this Prince William County property.)

To the northeast of the property, across Rt. 619, is a small residential area; directly north of it and across Rt. 646 is a privately owned refuse pick up service and a private home, both located on the same piece of property. A small cemetery is also located across each of the two roads from the housing site. The first cemetery, to the east across Rt. 619, is fenced and well kept. The second, north across Rt. 646, is hidden by a heavy overgrowth of brush and trees and in complete disorder.

Figure 1 shows the general location of the facility.

2.2 DESCRIPTION OF FACILITY

Figure 2 presents the site plan of the housing property.

Housing Units

The housing area consists of 4.42 acres, includes nine units, and is situated at the intersection of Rts. 619 and 646. Five of the units (#1-#5) are single-family three-bedroom homes, and the other four units (#6-#9) are single-family two-bedroom homes. All units are of single-story construction. The houses were constructed by the U.S. Air Force in 1956 to provide housing for military personnel assigned to the Manassas Nike missile battery.

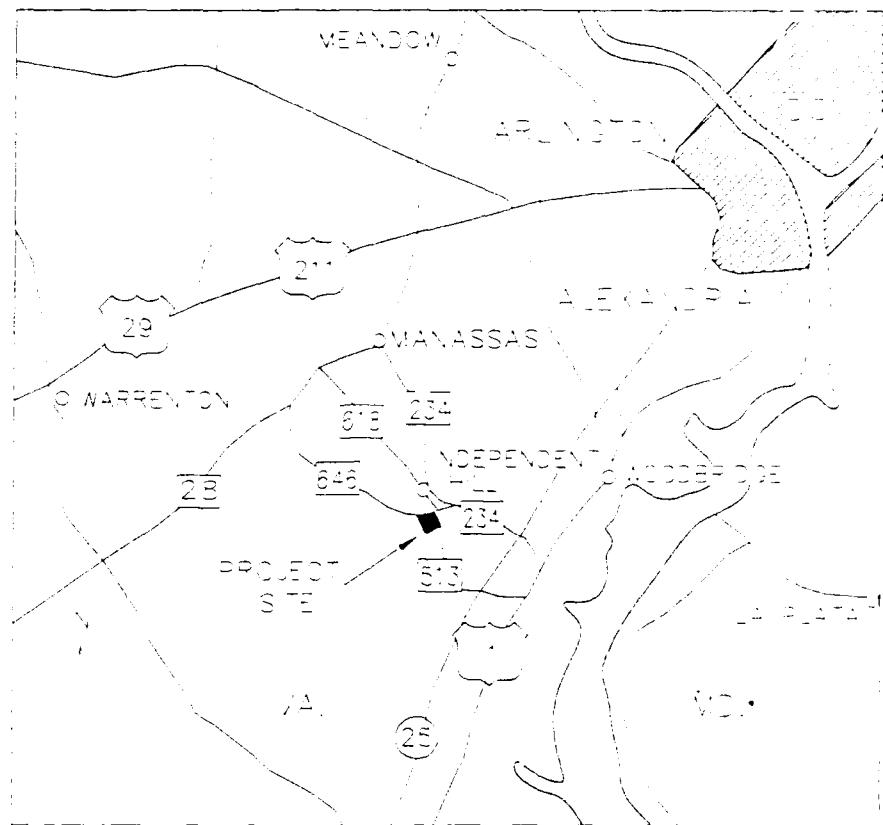


FIGURE 1 Location Map of Virginia Army Housing Facilities

Each unit was originally equipped with forced-air oil furnaces; air conditioning was added at a later date. An underground tank for storing diesel fuel was located behind each of the nine units. The tanks were removed in 1986.

There is a possibility that asbestos is present in the shake shingles on house sidings.² However, the shingles on all of the housing units appeared to be in good repair.

During early occupancy, electrical utilities were shared between the housing area and the adjacent fire-control site of the Nike battery. The units were heated until 1986 with forced-air oil systems that were supplied fuel from underground storage tanks.³

Utilities

All units have separate heating and cooling, provided since 1986 by Lenox heat pumps.³ Sanitary sewage services are provided by the Prince William County Authority (PWCA), as were the past sewage services for the Nike operational areas on land adjacent to the housing area. (The adjacent land is now owned and operated by the Prince William County School Board District.) Water has been provided by the PWCA since 1971. Prior to that, water was supplied by three private wells located on an adjacent property owned by Prince William County. Garbage collection and disposal

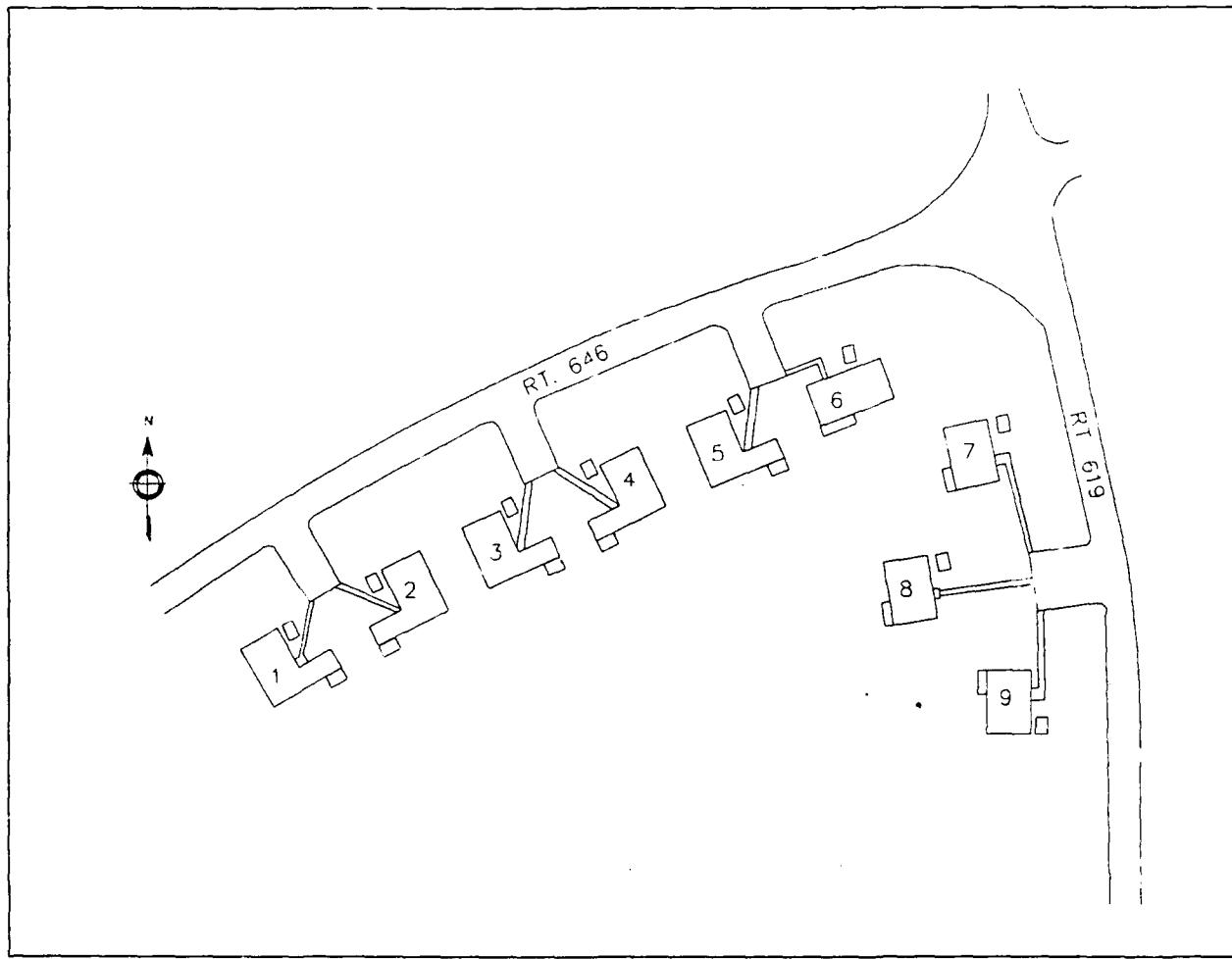


FIGURE 2 Site Plan Map of Manassas Army Housing Units

off-site are provided by a local contractor. Electrical services are provided by a public utility, the Northern Virginia Electric Cooperative, which owns the transformers on-site. During the 1956-1971 active life of the Nike battery, however, power was provided to the housing area by the adjacent fire-control area of the battery. No records are available to indicate whether the underground utility power line was properly removed or sealed when the Nike battery was decommissioned.

Fuel Storage

Nine underground diesel fuel storage tanks were originally installed, one for each house. Two of the underground tanks were found to be leaking about seven years ago. At that time it was decided that all nine tanks should be removed and all the present heating and cooling systems be replaced with heat pumps.³ This undertaking was completed three years ago. There is no documentation available which speaks to the presence or extent of petroleum subsurface contamination in the vicinities of these tanks or which details remedial actions at the time of the tank removals.

Currently, there are no underground fuel-storage tanks at this site.

Storm Drainage System

The storm drainage for the housing units is of the common type of open ground ditches and surface runoff.

Other Permanent Structures or Property Improvements

During the fall of 1971, extensive water and sanitary sewage work was performed at the site. Water hook-up to the Prince William County Authority was completed, and the disconnect from Nike site also took place at this time. Other improvements included the replacement of floor coverings in each of the units in 1977,⁴ and the installation of Lenox heat pumps at all units in 1986. Conversions from oil-fired furnaces to heat pumps appear to have been coincident with the decision to remove deteriorating underground fuel-storage tanks. It is not known, however, whether the floor coverings were replaced because of deterioration.

2.3 PROPERTY HISTORY

2.3.1 Nike Defense Program and Typical Battery-Level Practices

Generic information on the national Nike antiaircraft defense program has been compiled in two studies, one commissioned by the Army Corps of Engineers⁵ and the other by the U.S. Army Toxic and Hazardous Materials Agency.⁶ In both studies, independent contractors relied on information contained in unclassified documents related to the Nike surface-to-air missile program, including engineering drawings and specifications (for the facilities and the missiles themselves), interviews with Army personnel participating in the Nike program, and operations manuals and directives relating to the operations and maintenance of Nike facilities. Taken together, these two reports represent the most complete assemblage of generic information on the Nike missile program from an environmental perspective. Salient points from both reports are condensed below.

At its zenith in the early 1960s, the Nike program included 291 batteries located throughout the continental United States. The program was completely phased out by 1976, with many of the properties sold to private concerns or excessed to state or local governments for nominal fees.

Nike Ajax missiles were first deployed in 1954 at installations throughout the continental United States, replacing, or in some cases augmenting, conventional artillery batteries and providing protection from aerial attack for strategic resources and population centers. Typically, Nike batteries were located in rural areas encircling the protected area. The Ajax was a two-stage missile using a solid-fuel booster rocket and a liquid-fuel sustainer motor to deliver a warhead to airborne targets.

The Ajax missile was gradually replaced by the Nike Hercules missile, introduced in 1958. Like the Ajax, the Hercules was a two-stage missile, but it differed from the Ajax in that its second stage was a solid-fuel rather than liquid-fuel power source and its payload often was a nuclear rather than conventional warhead. Ajax-to-Hercules conversions occurred between 1958 and 1961 and required little change in existing Nike battery facilities. A third-generation missile, the Zeus, was phased out during development and consequently was never deployed.

A typical Nike missile battery consisted of two distinct and separate operating units, the launch operations and the integrated fire control (IFC) operations. The two operating areas were separated by distances of less than two miles, with lines of sight between them for communications purposes. A third separate area was also sometimes part of the battery. This area was typically equidistant from the two battery operating sites and contained housing for married personnel assigned to the battery. Occasionally, these housing areas also contained battalion headquarters, which were responsible for a number of Nike batteries.

Depending on area characteristics and convenience, the housing areas were often reliant on the launch or IFC sites for utilities such as potable water, electrical power, and sewage treatment. In those instances, buried utility lines connected the housing area to one or both of the other battery properties. It is also possible, however, that housing areas were completely independent of the missile launcher and tracking operations. In those instances, the necessary utilities were either maintained on the housing site or purchased from the local community. In many localities, as the character of the land area around the housing units changed from rural to suburban or urban, communities extended utility services to the housing unit locations, in which case conversions from independent systems to community systems were made.

A large variety of wastes was associated with the operation and maintenance of Nike missile batteries. Normally encountered wastes included benzene, carbon tetrachloride, chromium and lead (contained in paints and protective coatings), petroleum hydrocarbons, perchloroethylene, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and trichloroethylene. Because of the rural locations of these batteries, and also because very few regulatory controls existed at that time, most of these wastes were managed "on-site." (Unused rocket propellants and explosives, however, would always have been returned to central supply depots and not disposed of on-site.) It is further conceivable that wastes generated at one of the Nike properties may have been transferred to its companion property for management or disposal.

Wastes related to missile operation and maintenance would not have been purposely transferred from a battery operating area to a housing area with no facilities for waste management or disposal. In some instances, however, the sewage treatment facilities for all Nike battery properties were located at the housing area; that possibility cannot be automatically ignored. Finally, where housing areas received various utilities from either of the operating areas, it is also possible that wastes disposed of on those other properties may have migrated to the housing area via the buried utility lines. And since decommissioning of the Nike batteries did not normally involve removal of buried utility or communication lines, any such contaminant migration is likely to have gone unnoticed.

2.3.2 Manassas Housing Units

The nine units were constructed in 1956 to house Army personnel assigned to the Manassas Nike battery. At the time of construction, the property was owned by the U.S. Marine Corps. The first use of the area, however, was by the Army, for Nike battery housing. When the Army Nike battery was decommissioned, the property was reassigned by the Quantico Marine Base to the Manassas Air Force Station, either in 1970 or 1971. It was again reassigned in 1971, this time to the Vint Hill Farms Station of the Air Force. Also, when the battery was decommissioned, the adjacent land parcel to the south, which contained the Nike fire-control operations, was deeded to Virginia and has subsequently become owned by Prince William County. This adjacent area is now used as a school district administrative headquarters. Previously, however, it was the site of Nike fire-control operations for the Manassas battery.

There have been no major structural changes in the housing units since construction in 1956.

During the active life of the Nike battery with which this housing area was affiliated, electrical power, water, and sewer utilities were provided to the housing units from the adjacent Nike fire control area. When the battery was decommissioned, the fire control area was deeded to the State of Virginia, and alternative utility connections were established. However, there is no documentation on the decommissioning of the original underground water and sewer lines. They are presumed to have been sealed and abandoned in place. The fire-control area is slightly downgradient from the housing area.

2.4 ENVIRONMENTAL SETTING AND SURROUNDING LAND USES

The 1980 census shows the population of Manassas as 15,438; that of Virginia as 5,346,279; and that of Prince William County as 144,703.

The Manassas housing area is located in the Piedmont Physiographic Province, which includes parts of 40 counties in Virginia. Bordered on the west by the Blue Ridge Province and on the east by the Coastal Plain Province, the Piedmont encompasses about 40% of Virginia's land area. The Piedmont is predominantly a rural setting, with forest and pasture its major land uses. According to the 1980 census, approximately 41% of the Virginia population lives in the Piedmont Province. Excluding water used in cities and by thermoelectric plants, the estimated amount of water used in the Piedmont during 1980 was 272 million gallons per day. Approximately 43% of this amount is groundwater.

The province is characterized by gently rolling hills and long ridges whose orientation tends to be northeast-southeast. Elevations range from about 200 feet above mean sea level in the east to 1,000 feet MSL along the western boundary. Local relief between highland areas and valley floors may exceed 100 feet.

An intricate network of rivers and streams dissects the Piedmont Province. While most of the drainage system follows a dendritic drainage pattern, some streams follow nearly straight courses called lineaments. These linear features are controlled by fracture systems in the underlying bedrock. Major rivers crossing the Piedmont include

the Potomac, Rappahannock, James, Appomattox, Nottoway, Meherrin, Roanoke, and Dan. Major lakes include Lake Anna and the John Kerr Reservoir.

The climate of the Piedmont Province is mild and humid, with an average annual temperature of about 56°F. Temperatures are generally lowest in January and highest in July. The Piedmont receives an average annual precipitation of about 44 inches. Although rather evenly distributed throughout the year, average monthly precipitation usually increases in the late spring and summer and decreases in the fall.

2.5 GEOLOGIC AND HYDROLOGIC SETTINGS

The Piedmont Province consists primarily of metamorphic rock containing igneous intrusions of varying size. Major rock types include schist, gneiss, marble, slate, and quartzite, all of which may be intruded by granite and diabase. Five sedimentary basins intruded by diabase sills and dikes are located in the Piedmont. Rocks in these basins include sandstone, siltstone, shale, conglomerate, and coal.

Bedrock throughout the Piedmont Province is overlain by a nearly continuous layer of loose, weathered material. Referred to as "regolith," this material is composed of soil, saprolite (well-weathered rock), and alluvium (deposited by streams). The thickness of the regolith exceeds 100 feet in some areas of the Province.

The geologic structural trend is northeast-southwest, generally paralleling the fall line (border between the Piedmont and Coastal Plain Province). The line extends northeast into Maryland, Pennsylvania, and New Jersey, and southwest into North Carolina, South Carolina, and Georgia. While rock formation names vary from state to state, rock composition and structure are similar throughout the Piedmont Province.

Precipitation in the Piedmont is a significant source of its water; the Piedmont's only other source is surface water in streams passing through from other geologic provinces. The hydrologic cycle in the province functions as follows. Precipitation reaching the land surface either runs off into streams, which make their way back to the oceans, or infiltrates the ground to pass through a more complicated, circuitous route to the sea. Water following the complex ground route supplies basic human needs for water as well as the needs for much of the Piedmont's flora and fauna.

Water infiltrating the ground surface moves downward through the soil zone, under the force of gravity, until it reaches impermeable rock. On the way through the soil and underlying saprolite, some water remains lodged between the mineral grains and is available to the roots of plants in the unsaturated zone (zone of aeration). Much of this water, known as soil moisture or capillary water, is eventually returned to the air through evapotranspiration.

Water passing down to impermeable rock saturates the materials immediately above the rock and the fractures present within the rock. The upper surface of this saturated zone (zone of saturation) is referred to as the water table. Water below the water table may replace the soil moisture lost through evapotranspiration by moving up through the unsaturated zone by capillary movement.

Water in the saturated zone below the water table can also be removed by constructing a well penetrating below the water table and installing a device such as a pump to lift the water to the land's surface.

3 ENVIRONMENTALLY SIGNIFICANT OPERATIONS

The PA team from ANL identified ESOs at the Manassas housing area as (1) the sites of former underground fuel-storage tanks, some of which are known to have leaked; and (2) the possibility that former underground utility lines between this housing area and the adjacent Nike missile fire-control site have not been properly removed or sealed.

3.1 UNDERGROUND FUEL-OIL STORAGE TANKS

At the time of original construction there were nine 550-gallon underground storage tanks that contained #2 diesel fuel for the oil-fired furnaces in the housing units. Coincident to the conversion to heat pumps at all units, all tanks were removed. This conversion began seven years ago and was finally completed three years ago. It is suspected that some fuel oil could have been lost during the period of use or during removal of the tanks. There is no documentation as to the presence or extent of the fuel contamination.

3.2 UTILITY OR SERVICE CONDUITS

There is no documentation that indicates whether former underground utility service conduits between the housing area and the battery's fire-control site have been properly removed or sealed.

4 KNOWN AND SUSPECTED RELEASES

Based on information made available to the ANL team of investigators, there has been no known release to surface water, groundwater, or releases to the air that would have a negative effect on health or the environment. There is no known danger or threat from toxic or hazardous waste contamination, or from military ordnance, explosive waste, or debris. There are no known PCBs on or associated with the property being excessed; four pole-mounted transformers in the area are the property of the electric utility. Inorganic siding on the housing units may be of the asbestos type, and no information was found indicating that other asbestos-containing materials were used in the construction of the housing units. Underground storage tanks that were originally at the site for heating proposes were removed and replaced by modern heat pumps, and there are currently no underground tanks in the area. There is the possibility that former underground utility lines, which were shared between the Nike fire-control site and the housing area, have not been properly removed or sealed.

Some groundwater contamination was identified in 1986 in water samples from one of the wells located on adjacent property (now owned by PWCA School District), and this problem is an outstanding issue.⁷ There is no available documentation to prove that any of the three wells have been closed. Although an alternative water supply has been chosen, no effort was made to characterize or remediate the apparent groundwater contamination. Without such a deliberate study, the source (or sources) of contamination cannot be specifically identified. However, these sources are not likely to originate at the housing property.

5 PRELIMINARY ASSESSMENT CONCLUSIONS

The environmentally significant operations associated with the property are (1) the sites of former underground fuel-oil storage tanks, which were replaced in 1986; and (2) the possibility that former underground utility or service conduits between the housing area and the Nike missile fire-control site have not been properly removed or sealed.

The decision to convert the housing units from oil-fired furnaces to heat pumps appears to have been driven, in part, by the known deterioration of some of the underground storage tanks. However, although those tanks have since been removed, there is no documentation that establishes the absence of petroleum contamination or the proper removal of contaminated soils encountered during tank removals.

The existing gradient between the housing area and the adjacent former fire-control area suggest that the possibility of contaminant migration along buried former water and sewer lines connecting these properties is slight. However, there is no documentation that provides details of the abandonment of these lines in 1971.

6 RECOMMENDATIONS

There is evidence that the underground fuel-oil storage tanks that were used in the past were deteriorating at the time they were removed. However, it is not known whether subsurface contamination was encountered or, if so, whether all contaminated soils were properly removed at the time of tank removal. Therefore, soils in the areas of the former tanks should be sampled for petroleum contamination; any problems found should be remediated in an acceptable manner.

During early occupation of the Nike missile site and the Manassas housing area, water and sewer utilities were shared between the housing area and the fire-control site through underground lines. There is a possibility that these former underground utility lines were not properly removed or sealed. An investigation is needed to determine whether the said lines were properly abandoned.

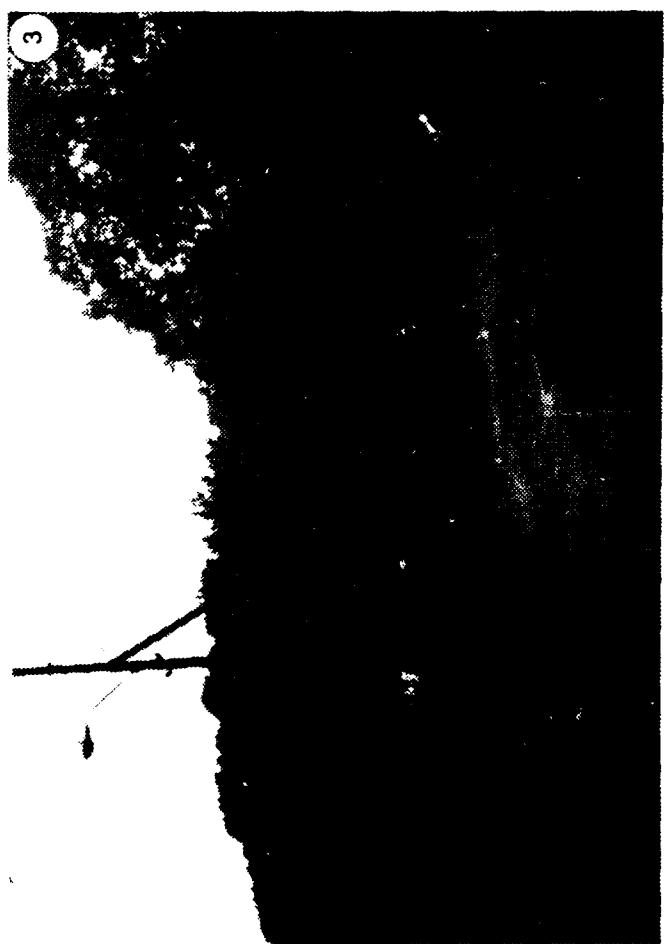
The recommendations assume this property will most likely continue to be used for residential housing.

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7. Memorandum from Robert Z. Grimes, Superintendent/School Services, Prince William County Public Schools, to Military Residents at Independent Hill, subject, "Water Supply at Independent Hill" (Jan. 10, 1986).

APPENDIX:

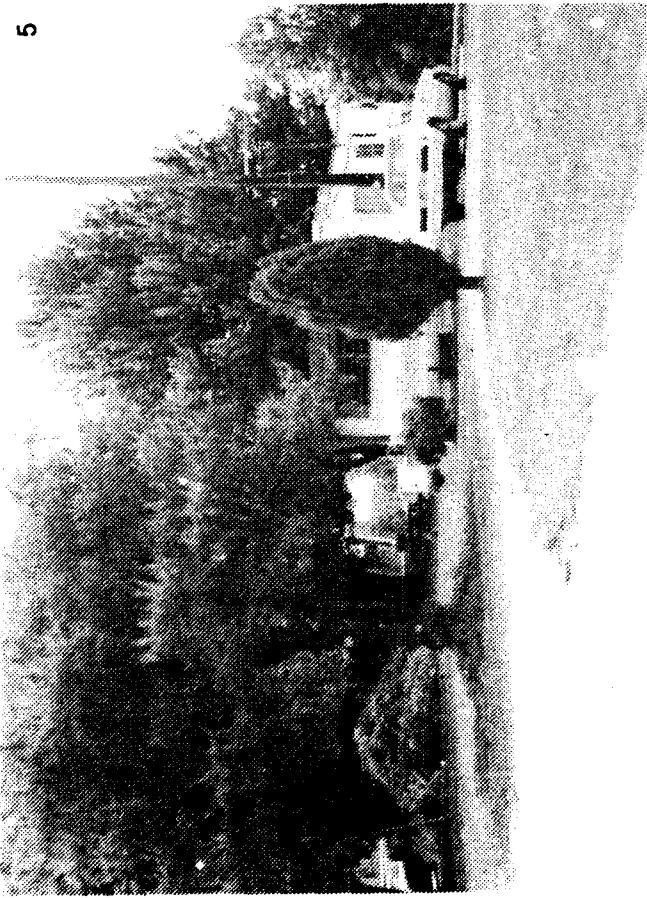
**PHOTOGRAPHS OF MANASSAS HOUSING FACILITY
AND SURROUNDING LAND**



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IDENTIFICATIONS OF PHOTOGRAPHS

1. One of the Army housing units on Route 619.
2. Electrical transformers mounted near the top of a utility pole; transformers are the responsibility of the local utility company.
3. Playground area for children.
4. Private homes in the vicinity of the Army housing units; the homes lie to the northeast of the housing area.
5. Private trailer park, north of the area.
6. Buildings behind the fenced area belong to the Prince William County School District; that area was formerly occupied by a Nike operation and is south of the housing area.
7. Cemetery grounds just west of the housing area.

